

Hybrid Modeling Capability for Aircraft Electrical Propulsion Systems, Phase I

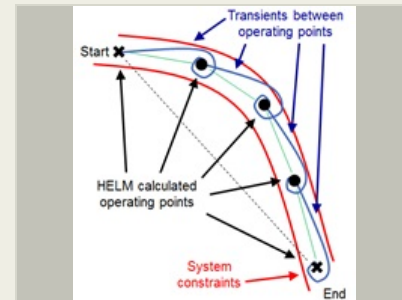
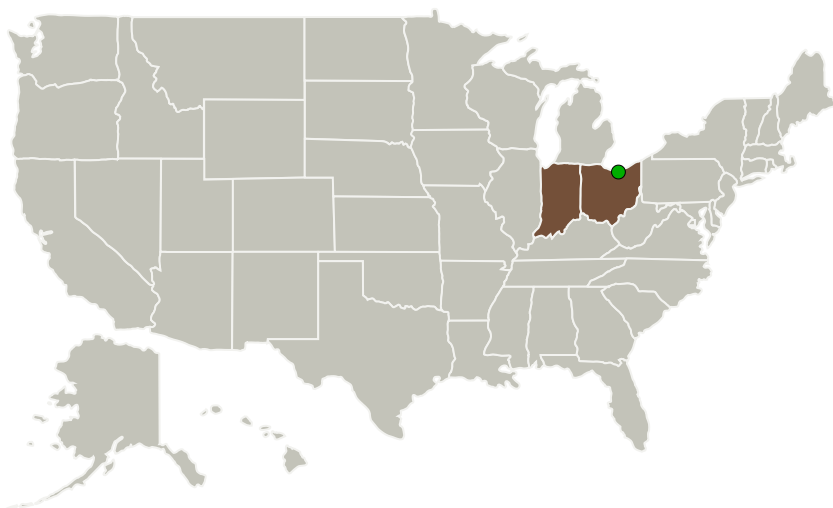
Completed Technology Project (2016 - 2017)



Project Introduction

PC Krause and Associates is partnering with Purdue University, EleQuant, and GridQuant to create a hybrid modeling capability. The combination of PCKA's extensive dynamic modeling experience, Purdue's work in electromechanical systems analysis, and GridQuant and Elequant's development of the HELM algorithm uniquely positions the team to create this technology. HELM is a novel algorithm that solves the powerflow equations of electric power systems using a direct, constructive procedure. It was originally derived for terrestrial power grids and is now being applied to dc spacecraft power systems. The Phase I effort will focus on three technical objectives. The first is to provide a formal definition of the mathematical framework for the hybrid modeling capability. The second objective is to define a software architecture for its implementation. Lastly, the third objective is to demonstrate the capability on an aircraft electrical propulsion system. The test system is anticipated to be a variable-voltage/variable-frequency ac electrical propulsion system that PCKA is currently investigating with NASA as part of a Convergent Aeronautics Solutions (CAS) effort. Another alternative is the Hybrid Gas Electric Propulsion (HGEP) Project's NASA Electric Aircraft Testbed (NEAT) system, which PCKA is also currently modeling. Some potential applications for this modeling technique include some of these applications include 1) efficient contingency analysis, 2) model-based control, 3) system identification and monitoring, and 4) analysis of pulsed loads.

Primary U.S. Work Locations and Key Partners



Hybrid Modeling Capability for Aircraft Electrical Propulsion Systems, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Hybrid Modeling Capability for Aircraft Electrical Propulsion Systems, Phase I

Completed Technology Project (2016 - 2017)

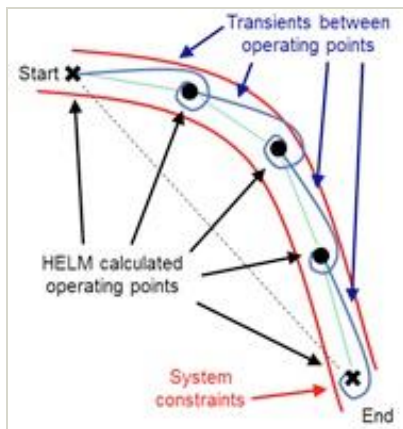


Organizations Performing Work	Role	Type	Location
PC Krause and Associates, Inc.	Lead Organization	Industry	West Lafayette, Indiana
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
Purdue University-Main Campus	Supporting Organization	Academia	West Lafayette, Indiana

Primary U.S. Work Locations

Indiana	Ohio
---------	------

Images



Briefing Chart Image

Hybrid Modeling Capability for Aircraft Electrical Propulsion Systems, Phase I

(<https://techport.nasa.gov/image/130253>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

PC Krause and Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

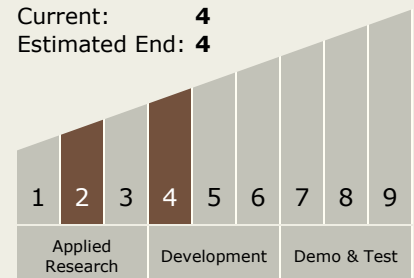
Carlos Torrez

Principal Investigator:

Benjamin Loop

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



Hybrid Modeling Capability for Aircraft Electrical Propulsion Systems, Phase I

Completed Technology Project (2016 - 2017)



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.3 Power Management and Distribution
 - └ TX03.3.1 Management and Control

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System